

Machine and ribbon spool for thermal transfer printing

The present invention relates in general to thermal transfer printing of images on items, such as boxes or packages for products.

In the present description the word "image" is used in its broad sense to mean a text, drawing, logo, bar code or any other two-dimensional graphical representation.

In a first aspect the subject of the present invention is a thermal transfer printing machine of the type known for example from European Patent EP-0 572 999-B1 in the name of this Applicant, and its object is to provide improvements to such a machine.

This and other objects are achieved according to the invention with a thermal transfer printing machine whose salient features are defined in the attached Claim 1.

In another aspect, the subject of the present invention is a ribbon spool for a thermal transfer printing machine, the object being to provide improvements to such a ribbon spool.

This and other objects are achieved according to the invention with a ribbon spool whose main features are defined in the attached Claim 5.

Other aspects, features and advantages of the present invention will become clear in the course of the following detailed description, given purely by way of non-restrictive example, with reference to the appended drawings, in which:

Figure 1 is a partial view in front elevation of a ther-

mal transfer printing machine according to the present invention;

Figure 2 is a partial view on a larger scale, taken on the section plane marked II-II in Figure 1;

Figure 3 is a partially sectioned view of a spindle used in the machine according to Figure 1;

Figure 4 is a cross section view taken on the plane marked IV-IV in Figure 3;

Figure 5 is a perspective view of the spindle shown in Figures 2 and 3;

Figure 6 is a front view of a ribbon spool according to the present invention;

Figure 7 is a view in section taken on the plane marked VII-VII in Figure 6;

Figure 8 is a front view that shows a ribbon spool according to the present invention;

Figure 9 is a view in section on the plane marked IX-IX in Figure 8; and

Figure 10 shows an insert for a ribbon spool according to the invention.

In Figure 1, M is a general reference for a machine for the printing of images by thermal transfer according to the present invention.

In the embodiment illustrated by way of example, this machine comprises a supporting structure S in which rotatable spindles 1 and 2 carry reels 3 and 4, respectively, on which an auxiliary or receiving ribbon N and an inked ribbon R, respectively, are wound, for carrying out printing methods of the type described in the abovementioned European Patent.

The ribbons R and N are of essentially the same width and

follow respective predetermined paths in the machine M.

In the embodiment illustrated by way of example, the ribbons N and R are brought together downstream of their respective winding reels 3 and 4 at a first turn roller R1 and then pass together between another turn roller R2 and a thermal dot-line print head H, of a type known per se. Downstream of this print head the inked ribbon R is again deflected by a roller R3 and then continues towards a thermal transfer device (not shown) of a type known per se, for example of the heated transfer roller or pad type. On returning from the thermal transfer device, the ribbon R passes around turn rollers R4 and R5, and finally comes to a rewinding reel, marked 6 in Figure 1, mounted on a driven spindle 2'.

Downstream of the deflection roller R2 the auxiliary ribbon N runs on past another deflection roller R6 to a rewinding reel 5 mounted on a driven spindle 1'.

Advantageously, the spindles 1 and 2 that carry the reels 3 and 4 (and the rewinding spindles 1' and 2') are made as will now be described with reference to Figures 2 to 5, and correspondingly the reels 3 and 4 (and the reels 5 and 6) comprise respective ribbon spools 30 advantageously made as will be described with reference to Figures 2 and 6 to 10.

Referring particularly to Figures 2 and 3, a spindle 1 of this kind essentially comprises a shaft 10 mounted rotatably via a bearing 11 in a retaining element 12 fixed to the supporting structure S by means of screws 13.

The shaft 10 has a cylindrical portion 14 of enlarged diameter integral with an intermediate portion 15, also cylindri-

cal, of the spindle. Two diametrically opposite longitudinal slots marked 16 and 17 are formed in the intermediate portion 15 of the spindle. These slots, which may advantageously have an essentially rectangular cross section, each receive a key element 18 and 19, respectively (see in particular Figures 2 to 4).

As can be seen more clearly for example in Figures 3 and 5, two circumferential and axially separate grooves 20 and 21 are formed in the intermediate portion 15 of the spindle 1. Elastic sealing rings 22, 23, respectively, are engaged in these grooves. These rings act elastically on the key members 18 and 19 to keep them in contact with the bottom walls of the slots 16 and 17 of the intermediate portion 15 of the spindle.

Away from the head 14, the intermediate portion 15 of the spindle meets a terminal axial portion 24 of the spindle, having a reduced diameter, a shoulder 25 being formed in the transition (see for example Figure 5).

The key members 18 and 19 have respective end portions 18a and 19a that extend along the axial portion 24 of the spindle 1, to which they present respective shaped profiles or inclined planes 18b and 19b.

The axial portion 24 of the spindle has an external thread 26 on which a tapped part 27 is screwed. Advantageously, but not necessarily, the free end 27a of the tapped part has a squashed, essentially plate-like configuration that can easily be gripped for screwing or unscrewing the said tapped part onto or off the threaded portion 26 of the spindle.

The opposite end 27b of the tapped part 27 advantageously has a conical outer surface (Figure 3).

When the tapped part 27 is screwed onto the threaded shank 24 of the spindle, the end 27b of the tapped part is able to engage against the inclined planes 18b and 19b of the key members 18 and 19. This essentially pushes the key members apart in a generally radial direction, towards the exterior, for reasons which will become clearer later.

With reference to Figures 2, 6 and 7, in the embodiment illustrated the reel 3 of auxiliary ribbon N comprises a ribbon spool which has the general reference 30.

This spool 30 has an essentially cylindrical tubular general form with an axial passage 31 running through it to accommodate the spindle 1.

In the embodiment illustrated the ribbon spool 30 comprises a cylindrical tubular core 32 of e.g. pressboard, on which the auxiliary ribbon N is rewound, and a cylindrical tubular insert 33 made of an essentially more rigid material, e.g. moulded plastic.

The insert 33 is shorter than the core 32 and is fixed inside the latter by for example driving it in axially with radial interference in such a way that its end 33a located furthest inside the core 32 defines an annular locating shoulder designed to meet the shoulder 25 of the spindle 1.

Advantageously, as seen in Figure 10, the insert 33 may be provided with a plurality of peripheral projections 34, such as ribs or fluting, for digging into the inside surface of

the core 32 and improving the grip between the two.

Referring to Figures 6 and 7, in the inside surface of the insert 33, two diametrically opposite slots 35 and 36 are made.

Due to the presence of the insert 33, the axial passage 31 defined in the ribbon spool 30 effectively has a first portion 31a of larger diameter, and a second portion 31b of smaller diameter. These portions of the passage 31 meet at the shoulder 33a formed by the innermost end of the insert 33 (Figure 7).

Referring to Figure 2, the total length L of the ribbon spool 30, that is the length of the core 32, is such that when the spool is placed on the spindle 1 the tapped part 27 partly protrudes from the spool.

The reel 3 of auxiliary ribbon N can be pushed onto the spindle 1 until the shoulder 33a of the spool meets the corresponding reference and stop shoulder 25 of the spindle 1. When connected, the end portions 18a, 19a of the key members 18 and 19 of the spindle extend along the slots 35 and 36, respectively, of the insert 33, forming a prismatic coupling between the spool 3 and the spindle 1. By turning the tapped part 27 it is thus possible to radially open the ends 18a and 19a of the key members 18 and 19 against the bottom walls of the slots 35 and 36 of the spool 30 for effective clamping, so that the spool 3 and the spindle 1 are held firmly together when rotated.

As will be clear from the above description, the shoulder 33a and the slots 35 and 36 of the ribbon spool are such that the

spindle 1 can be connected to the reel 3 only by introducing this spindle through the large-diameter end 31a of the axial passage 31.

Referring to Figure 2, the length I of the insert 33 is equal to half the length L of the core 32. This feature ensures that the reel 3 is central when positioned on the spindle 1, relative to the shoulder 25, independently of the width L of the ribbon N used.

The axial passage 31 through the ribbon spool, with its change of cross section, ensures that the reel 3 cannot be mounted on the spindle the wrong way round. This feature is particularly helpful in a machine such as that shown in Figure 1, where the auxiliary ribbon N and the inked ribbon R are rewound in opposite directions on their respective ribbon spools, and are therefore intended to unwind in use in opposite directions (see Figure 1, and also compare Figures 6 and 7 relating to the reel 3 of auxiliary ribbon N with Figures 8 and 9 which relate instead to the reel 4 of inked ribbon R).

The solution described thus far is particularly advantageous as it makes it possible to use reels of auxiliary ribbon N or inked ribbon R of standard type, usually produced on a tubular cylindrical core, of e.g. pressboard, with a constant diameter of its internal passage. In this case it is advantageously possible to insert a respective insert, such as the insert 33 described earlier, into the cores of these reels.

Advantageously, the inserts 33 of the reels 3 and 4 of auxiliary ribbon N and inked ribbon R, respectively, have a visible feature, such as colour, which they share with the corre-

sponding spindle 1 or 2 (or at least part thereof, such as the tapped part 27), this characteristic being different for the two spindles 1 and 2 and for the cores 33 of the respective ribbon spools. For example, cores 33 of spools carrying the auxiliary ribbon N and the tapped part 27 of the corresponding spindle 1 may be red, while cores 33 and spools carrying the inked ribbon R and the tapped part 27 of the corresponding spindle 2 may be black.

In an alternative embodiment (not shown) the ribbon spools for the reels of auxiliary ribbon and inked ribbon may be made in one piece, e.g. a single plastic moulding, with an overall shape corresponding to the unit formed by the core 32 and insert 33 of the spools 30 described above.

The above description also applies to the spindles 1' and 2' and the associated ribbon rewinding spools. When in use, the spools 30 of the reels of ribbon 3 and 4, once fully unwound, can be removed from the spindles 1 and 2 and mounted on the spindles 1' and 2' (the reels of rewound ribbon having first been removed), allowing them to be used as rewinding spools in the next operation.

Clearly, without departing from the principle of the invention, the embodiments and the construction details may differ greatly from those described and illustrated purely by way of non-restrictive example, without their departing from the scope of the invention, as defined in the accompanying claims.